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EXAMINER	
UHLIR, NIKOLAS J	

ART UNIT	PAPER NUMBER
1773	

DATE MAILED: 08/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/900,771	MASE ET AL.
	Examiner	**Art Unit**
	Nikolas J. Uhlir	1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 May 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to the arguments submitted 05/20/2004. Applicant's amendment/arguments have been fully considered but are not found to be persuasive in overcoming the cited prior art. Currently, claims 1, and 3-20 are pending.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 4-5, 8-9, 12-13, 15-16, and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Long et al. (US6176453) in view of Okamoto et al. (EP0919647a1).

3. The examiner notes that EP0919647a1 is an equivalent to the previously cited US2001/0027856. However, unlike the US document, EP0919647a1 was published on 06/02/1999 and thus is valid prior art under 35 U.S.C 102(b).

Claim 1 requires a composite material heat controller for an object, the composite material heat controller comprising: a base material that radiates a larger amount of heat at high temperature relative to that of a low temperature, the base material having a surface adapted to thermally contact a surface of the object; and a phase change substance overlying the base material, wherein the phase change substance has insulation properties at a high temperature, metallic properties at low temperature, and the phase change substance radiates larger amounts of heat at high temperature

relative to the amount of heat at low temperature, wherein the phase change substance has a high reflectivity in the thermal infrared region at low temperature; wherein said phase change substance comprises a thickness in the range from about one to about thirty microns.

4. Regarding these limitations, Long et al. (Long) teaches a radiator structure comprising a heat source 36 (equivalent to applicants claimed object), a radiator element 30 having an inner surface in thermal contact with the heat source through a thermal transfer medium 38, and a coating 44 in contact with the outer surface of the radiator element (see figure 2a and column 4, lines 17-50). It is the examiners position that the radiator body 28 and the coating 44 are equivalent to the applicants claimed base material that radiates larger amounts of heat at high temperature then at low temperature, wherein the base material has a surface that is adapted to thermally contact the object.

5. Long fails to teach a phase change substance that is about one to about thirty microns thick overlying the base material, wherein the phase change substance exhibits the properties required by claim 1.

6. However, regarding this deficiency, Okamoto et al. (Okamoto) teaches a heat control device suitable for use on an artificial satellite or spacecraft (column 1, section 1). This heat control device comprises a variable phase substance arranged on the heat radiation surfaces of a spacecraft. The variable-phase substance is a manganese perovskite oxide that undergoes a phase transition around room temperature. This substance has the characteristics of a metal at the low temperature phase, and the

characteristics of an insulator at the high temperature phase. Further, this substance has a low heat radiation ratio at low temperature, and a high heat radiation ratio at high temperature (column 2, section 11). Figure 2 clearly shows that this material exhibits higher infrared reflectivity in the low temperature phase as opposed to the high temperature phase. Thus, the phase change material of Okamoto meets the material property requirements of claim 1 for the required phase change material. This phase-change material is mounted in the form of a film on the heat radiation surfaces of a spacecraft, and so is lightweight and space saving (column 3, section 14). Furthermore, this material regulates the amount of heat radiated from the surfaces of the spacecraft on order to control the internal temperature of the spacecraft (column 1, section 2 and column 3 section 16).

7. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to coat the phase change coating of Okamoto onto the surface of the coated radiator panel taught by Long.

8. One would have been motivated to make such a modification due to the teaching in Okamoto et al. that coating the radiator panel of a satellite with a phase change material of a manganese perovskite oxide allows the internal temperature of a spacecraft to be passively controlled within a desired temperature range.

9. Regarding the requirement that the phase change substance comprise a thickness in the range of about 1 to about 30μ. The examiner acknowledges that neither Long nor Okamoto teach this limitation. The examiner further acknowledges that Okamoto teaches in a specific example that the phase change material is suitably a

several hundred micron thick film (column 3, section 17). However, the recitation of a single suitable thickness by Okamoto does not teach away from using a film having any other thickness. Bearing this in mind, it is noted that the phase change film substance of Okamoto is configured so as to form a *lightweight* heat control device. Further, one of ordinary skill in the art of passive heat emission would understand that the thickness of a material will impact its heat radiative/conduction capabilities (admitted in applicants arguments dated 05/20/2004). In addition, it is well established that a thicker film of a substance necessarily weighs more than a thinner film of the same substance. Thus, the examiner takes the position that the thickness of the film of Okamoto is a results effective variable.

10. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to control the thickness of the phase change film utilized by Long as modified by Okamoto to a desired range so as to obtain a coating having a balance between weight and desired heat radiation/conduction properties.

11. Claims 4 and 5 require the phase change substance to be a perovskite oxide (claim 4), more specifically manganese perovskite oxide (claim 5). These limitations are met as set forth above for claim 1.

12. Claim 8 requires a reflective plate or reflective film each having reflectivity with respect to visible light to be laminated onto the phase change substance on a side opposite the side on which the base material is laminated. Regarding this limitation, Okamoto et al. teaches that when the phase change material is mounted on a position that receives sunlight, a silicon plate that is transparent to thermal infrared but opaque

to sunlight is positioned in front of the variable phase substance in order to minimize sunlight absorption (column 4, sections 22-23). As this silicon plate is opaque to visible light and is designed to minimize the absorption of sunlight, it is the examiners position that is will necessarily be reflective to visible radiation to some degree, and thus meets the reflection requirement in claim 8.

13. Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to use the silicon plate taught by Okamoto et al. above the phase change material utilized by Long as modified by Okamoto et al.

14. One would have been motivated to make this modification due to the teaching in Okamoto et al. that the silicon plate minimizes the absorption of sunlight by a phase change material that is mounted on the surface of a satellite that is exposed to sunlight.

15. Claim 9 requires a surface of the base material to be affixed to a surface of the object either directly or through an intervening heat conductive substance. With respect to this limitation, Long teaches that the radiator panel is attached to the heat source via a thermal transfer medium 38. It is the examiners position that this thermal transfer medium is equivalent to applicants claimed, "heat conductive substance."

16. Claim 12 requires the object in claim 1 to include a circuit used in a space vehicle, including man-made satellites and spaceships. This limitation is met as set forth above for claim 1, as Long and Okamoto clearly are directed towards the management of heat on spacecraft such as satellites.

17. Claims 13, 15-16, and 18-20 require a generic method for controlling heat in an object, wherein the method merely requires "attaching," or "providing" the layers

required in claims 1, 4-5, 8-9 and 12. As the combination of Long with Okamoto necessarily requires these steps, the limitations of claims 13, 15-16 and 18-20 are met as set forth above for claims 1, 4-5, 8-9 and 12.

18. Claims 3, 6-7, 14, and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Long as modified by Okamoto as applied to claims 1 and 13 above, and further in view of Babel et al. (US5296285).

19. Long as modified by Okamoto does not teach a composite material heat controller wherein the base material of claim 1 comprises a thickness greater then that of the phase change substance.

20. However, it is noted that Long teaches that a suitable radiator element comprises an aluminum or aluminum alloy body that has been coated with a layer of white thermal control paint (column 4, lines 18-55). Long does not disclose a suitable thickness for the radiator element and white paint coating. Bearing this in mind, Babel et al. (Babel) teaches a high emittance, low absorptance coating for an aluminum substrate comprising a layer of anodized aluminum on the substrate, and a layer of white paint on the anodized aluminum (column 2, line 63-column 3, line 2). This coating is used as a thermal control surface of a spacecraft (column 4, lines 54-59). Babel teaches that the thickness of the anodized aluminum substrate and the white paint coating is in the range of 1.5-8 mils (38-203μ) (column 4, lines 44-53). Further, Babel et al. teaches that the total thickness of the anodized aluminum and the high emissivity coating affects the corrosion resistance of the coating, with corrosion resistance increasing as the total thickness increases from 1-8 mils (38-203μ) (column 3, lines 10-28).

21. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the anodized aluminum substrate coated with a layer of white paint taught by Babel as the radiator element in Long.

22. One would have been motivated to make this modification in light of the fact that Long teaches that an aluminum or aluminum alloy substrate coated with a layer of white paint is suitable for use as the radiator element, and the fact that the anodized aluminum substrate coated with white paint taught by Babel is specifically taught to be useable for this exact purpose.

23. Further, given the fact that the Babel teaches that the total thickness of the anodized aluminum and the high emissivity coating affects the corrosion resistance, with corrosion resistance increasing as the total thickness increases from 1.5-8 mils (38-203μ) (column 3, lines 10-28), the examiner takes the position that the thickness of the anodized aluminum substrate and white paint coating is a results effective variable.

24. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to control the thickness of both the anodized aluminum substrate and white paint coating and the thickness of the phase change material to a desired ran Claim 6 requires the base material to have a thickness of 10-100μ. This limitation is met as set forth above for claim 3, when the thickness of the anodized aluminum/white paint radiator is controlled to thickness of 1.5mils (38μ).

25. Claim 7 requires the base material to include a material selected from the group consisting of silicone, alumina, and partially stabilized zirconia. This limitation is met as

set forth above for claim 3, as anodized aluminum is known to have the formula Al_2O_3 which is also known in the art as alumina.

26. Claims 14 and 17 require a generic method of controlling heat in an object that requires "providing" or "forming" layers having the same limitations as claims 3 and 7. These limitations are met as set forth above for claims 3 and 7.

27. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Long as modified by Okamoto as applied to claim 1 above, and further in view of Bjorndahl et al. (US6005771).

28. Long as modified by Okamoto fails to teach the limitations of claim 10, wherein the applicant requires the base of claim 1 to be attached to the object via an appropriate intervening adhesive.

29. However, it is noted that Long teaches that the radiator panel is attached to the heat source via a thermal transfer medium, wherein the thermal transfer medium includes heat pipes, metallic strips, or other medium (column 4, lines 44-50).

30. Bearing the above in mind, Bjorndahl teaches that conduction of heat between a heat source (circuit) and a radiator panel can be improved by placing thermally conductive adhesive between the radiator panel and the heat source (column 1, lines 38-50).

31. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilizes thermally conductive adhesive as taught by Bjorndahl between the heat source and the radiator panel of Long as modified by Okamoto.

32. One would have been motivated to make this modification in order to enhance the conduction of heat between the heat source and the radiator panel.

33. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Long as modified by Okamoto as applied to claim 1 above, and further in view of Dalby (US4669685).

34. Long as modified by Okamoto does not teach the requirements of claim 11, wherein the applicant requires the object to comprise a non-flat surface.

35. For the purpose of this examination the examiner interprets "object comprises a non flat surface" to require an object generating heat to have at least 1 non-flat/planar surface. The examiner does not interpret this claim to require that the base material and phase change material be curved. Thus, claim 11 is read on by a satellite having heat generating elements incorporating curved fins, wherein a radiator panel is in thermal contact with the heat generating element and a phase change substance exhibiting the properties recited in claim 1 is applied to the radiator panel surface opposite the heat generating elements.

36. Bearing the above interpretation in mind, Dalby teaches that the transfer of heat between heat generating elements and a heat radiator panel in a satellite is improved through the use of curved fins on the heat generating elements. Specifically, the use of curved fins allows heat generated from the heat producing elements to have a clear path to the heat radiator panel surrounding the heat-generating element (column 5, lines 35-50).

37. Therefore it would have been obvious to one of ordinary skill in the art to incorporate curved fins as taught by Dalby onto the heat generating elements taught by Long as modified by Okamoto.

38. One would have been motivated to make this modification in light of the teaching in Dalby that the transfer of heat between a heat generating element and a radiator panel in a satellite is improved by providing curved fins on the heat generating elements.

Examiner Note

39. The examiner notes that JP11-217562 is also an equivalent to previously cited US2001/0027856 to Okamoto et al. As it was published in 1999, this reference is valid prior art under 35 U.S.C 102(a). For the sake of brevity, a redundant rejection over this reference has not been made.

Response to Arguments

40. Applicant's arguments with respect to claims 1 and 3-20 have been considered but are moot in view of the new ground(s) of rejection. The bulk of applicant's argument is drawn o the fact that Okamoto does not teach the claimed thickness of the phase change material. Further, given the knowledge in the art (that thickness impacts the thermal radiative/conduction properties of a film), one of ordinary skill in the art would not be motivated to modify the film of Okamoto to within the claimed range because the thin film would not have sufficient material to conduct heat away from the object and radiate the heat away.

41. The examiner understands applicant's argument but is not persuaded by it. As admitted by the reference, Okamoto is concerned with forming a lightweight heat radiative element. The examiner maintains that one of ordinary skill in the art would recognize that the weight of a thin film can be controlled by controlling its thickness. Further, the examiner acknowledges that the thickness of a thin film will impact its heat radiative/conduction properties. While the examiner acknowledges that the ability of the phase change film disclosed by Okamoto to radiate/conduct heat will likely be diminished to some degree, a thinner film of the phase change substance will still have the ability to radiate/conduct heat. Bearing this in mind, one of ordinary skill in the art who desires to conduct/radiate a small amount of heat from an object would clearly be motivated to modify the thickness Okamoto film so as to achieve a balance between coating weight and heat radiation/conduction properties. This is particularly true on spacecraft, where weight is of an utmost concern.

Conclusion

42. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 571-272-1517. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Deborah Jones can be reached on 571-272-1535. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NJU

D. S. NAKARANI
PRIMARY EXAMINER